(296)

TECHNICAL SPECIFICATION FOR RABBIT ACSR CONDUCTOR

1.0 SCOPE:

This specification covers manufacture, testing at manufacturer's works and supply of Rabbit ACSR conductor.

2.0 The basic technical and other particulars of the equipment and the various components are specified in the following sections and tender schedule.

3.0 CONSTRUCTION:

3.1 ACSR Conductor: The conductor shall comply in all respects with the latest edition of IS-398 (Part-II) 1996 with its latest amendment. The Aluminium wires used in the manufacture of the conductor shall be of the highest electrical quality and free from scratches, die marks and other surface imperfections. They shall be reinforced with a central core of galvanized high tensile steel wire having negligible sulphur and phosphorous contents.

3.2 The steel wire shall not be subject to any heat treatment after being galvanized. The zinc coating of steel wires shall be smooth and of uniform thickness. There shall be no bare spots owing to adherence of scales or other causes.

3.3 Joints in wires: Joints in the individual Aluminium, wires are permitted but no two such joints shall be within 15 meters apart in the complete stranded conductors. There should be no joints in the galvanized steel wire except those made in the base rod or wire before final drawing forming the core of steel reinforced Aluminium.

3.4 The resistance of the individual Aluminium wire shall be determined separately before stranding by means of standard tests on sample wires. The test samples shall be of sufficient length to give an accuracy of atleast one part in a thousand.

3.5 The ACSR conductor size and standard lengths shall be as per IS 398 (Part-II) 1996 with its latest amendments and as indicated below.

Code Name of Conductor	Nominal Aluminum Area	Dia of wires in mm		Sectional Area of Aluminum (mm^2)	Total Sectional Area (mm^2)	Extend calculated Resistance at 20°C (Max)	Appx. Calculated breaking load in KN	Appx. Over all dia (mm^2)	Std, length in Mtrs.	App. Mass Kg./ Km.
		Aluminum	Steel							
Rabbit	50 Sq.mm	6/3.35	1/ 3.35	52.88	61.70	0.5524	18.25	10.05	1400	214

4.0 STANDARD SIZES OF WIRES: The Aluminium wire and galvanized steel wire for the standard construction of conductors have diameter specified as shown below, as per Tables 1&2 Section of IS 398 (Part-II).

TABLE-1: Aluminium Wire used in the construction of Aluminium Conductors Galvanized Steel Reinforced.

Diameter in mm			Cross Sectional area of nominal dia wire	Mass	Resistance at 20° C ohm/Km.	Breaking load	
Nominal	Minimum	Maximum				Before stranding	After stranding
3.35	3.32	3.38	8.814 mm^2	23.82 Kg/Km.	3.265	1.43 KN	1.36 KN

TABLE-2: Steel wire used in the construction of Aluminium conductors galvanized steel reinforced.

Diameter in mm			Cross Sectional area of nominal dia wire	Mass	Breaking load	
Nominal	Minimum	Maximum			Before stranding	After stranding
3.35	3.28	3.42	8.814 mm^2	68.75 Kgs/Km	11.58 KN	11.0 KN

5.0 LAY RATIO: Ratio of the axial length of a complete turn of the helix formed by the individual wire in a standard conductor to the external diameter of the helix.

The lay ratio shall be as shown below.

TABLE-3: Lay Ratios of Aluminium Conductor, Galvanized Steel Reinforced.

Number of Wires		Ratio of Aluminium wire dia to Steel wire dia	Lay ratio for steel core		Lay ratio for Aluminium outside layer	
Aluminium	Steel		Minimum	Maximum	Minimum	Maximum
6	1	1.00	-	-	10	14

Note: For the purpose of calculation, the mean lay ratio shall be taken as the arithmetic mean of the relevant minimum and maximum values given in this table.

6.0 TESTS & INSPECTION OF RAW MATERIAL AT SUPPLIER'S WORKS:

4.1 Within two weeks of receipt of each consignment of raw materials viz., steel, Electrolytic Aluminium rods, etc., at the manufacturers works, the contractor shall furnish to the purchaser in triplicate the raw material manufacturers certificates.

4.2 The test certificates shall cover all tests on required number of samples as stipulated in clause 13.1 of IS. (Part-II) 1996 with latest amendments if any.

4.3 The manufacturer shall not commence manufacturing the conductor ordered prior to purchaser's approval of the test certificate for raw materials.

4.4 Similarly test certificates in triplicate for tests on the finished ACSR conductor shall be submitted. The suppliers shall furnish along with RCs, the number of pieces of conductor in each reel and the length of individual pieces.

4.5 All tests as detailed in clause 13 of IS-398 (Part-II) 1996 with its latest amendments shall be carried out on conductors covered by this specification and shall be submitted by the contractor for purchasers approval within four weeks of the acceptance of the letter of intent of the purchaser. No change in the schedule of tests, unless desired by the purchaser shall be subsequently made by the contractor or his sub-contractors of the manufacturers without prior - consent of the purchaser.

4.6 The purchaser may at any time call for any tests that are laid down in the specification as optional tests. The contractor shall arrange to carry out such tests expeditiously at his own cost. The certificates for such optional tests shall be submitted to the purchaser for approval.

4.7 The contractor shall notify the purchaser, at least fifteen days in advance, the time of manufacture so that inspection of materials during manufacture and or witnessing of the tests can be arranged. If the purchaser waives inspection he will advice the contractor accordingly. Inspection shall also include method of packing and stacking of finished materials in the works.

7.0 **Packing**: Drawing of the reels/drums shall be enclosed with tenders. The ACSR conductor reels shall be of dimensions approved by the purchaser and made of seasoned wood sufficient strong and in sound condition to ensure that the reels shall reach the site intact with lagging end free from damage due to transport hazards by rail and over land. These reels shall conform to IS 1778/1981 with latest amendments if any.

a) The standard length of the ACSR conductor shall be as per schedule of materials specification. Longer lengths are acceptable. However, short lengths not less than one Km. each are acceptable to the minimum extent of 5% of the quantity ordered.

b) The contractor shall submit in duplicate detailed packing specification for the conductors for the purchasers approval at least fifteen days prior to commencement of dispatch. Finally approved specification shall be furnished along with the dispatch documents.

8.0 REEL OR DRUM SHALL BEAR THE FOLLOWING INFORMATION

a) Reel or drum number
b) Size and description of contents
c) Length of each piece of conductor (on reels)
d) No. of pieces in each package/reel
e) Gross weight

(30)

f) Net weight

g) Purchase order No. & Date

h) Place and designation of consignee

The above details shall be legibly and indelibly marked.

9.0 The Bidder shall furnish the guaranteed technical particulars as per the Proforma enclosed to this specification.

TECHNICAL SPECIFICATION FOR GALVANIZED GROUNDING PIPES

1.0 TECHNICAL

1.01 This specification covers manufacture, test and supply of galvanized iron grounding pipes of 'B' Class (Medium Class) of 42 mm dia and 2.5 Mtrs. length and 3.2 mm thickness with G.I. Bolts, Nuts and Washers.

1.02 The G.I. Pipes shall be 'B' Class (Medium Class) manufactured as per IS 1239 (Part-I) 2004 and revision thereof, from quality steel. The pipes shall be reasonably free from scales. They shall be straight, free from surface flaws, cracks, laminations and other defects. The ends shall be cut clearly and sway with axis of pipe. Sulphur and Phosphorous contents of steel not exceed 00.04% each.

1.03 The dimensions and weight of GI pipes shall be as per Table 4 of IS 1239 Part-1 2004 subject to tolerance limits as specified.

1.04 **GALVANIZATION:**

The Galvanizing of pipes shall be done and the coating on the pipes shall be in accordance with the IS- 4736, 1968 and IS-2633/ 1972, weight of zinc coating shall be 400 Gms. Per Sq. Mtr and No. of dips shall be 4 of one minute each.

i) The GI Bolts and Nuts shall conform to IS: 6689.
ii) All ferrous parts to be galvanized as per IS: 5358.
iii) Heavy GI washers shall conform to IS: 6610.
iv) Grounding Pipe holes as per IS : 3043

1.05 **TEST CERTIFICATE**

All acceptance test as per IS 1239 (Part-I) 2004 on selected samples as per Tables I&II of IS 4711, 1974 shall be conducted and test results in the form of test reports signed by a responsible officer of the firm shall be sent for verification and approval before dispatching the materials. As per Clause 13 of IS 1239 (Part-I). 2004 Hydraulic test shall be conducted on each and every piece as a routine test.

1.06 **MARKING**

Each pipe shall be marked with letters BESCOM, with P.O. No. & Date, along with colour code, as per IS 1239 part-1, Colour: Blue.

1.07 Grounding pipes of 42 mm dia. meter shall be supplied in lengths of 2.5 Mtrs. with GI Bolts and Nuts and with holes drilled as detailed in the drawing No.BESCOM/GM/QS&S/27 dated 24.11.18. GI Bolts and Nuts shall be of reputed Make (The weight of GI pipe shall be as per IS before drilling 32 Nos. of holes).

1.08 **SAMPLE**

The Contractor shall submit two samples and get them approved by the competent authority before taking up the manufacture. The two approved samples will be kept as under.

i) One approved sample will be with the manufacturer at the manufacturing premises so that so that the inspecting officer can inspect the materials offered for inspection with reference to the approved sample.

ii) The second approved sample will be kept at BESCOM Stores, Rajajinagar, Bangalore.

1.09 **PACKING**

The grounding pipes shall be supplied securely packed so as to withstand easy but rough handling and acceptable for transport. The package containing the grounding pipe with bolts and nuts shall have a mark BESCOM, P.O No. and date and No. of pieces in the package.

TECHNICAL SPECIFICATION FOR HEAT SHRINKABLE TYPE, TAPE X TYPE, PRE MOULDED TYPE AND COLD SHRINKABLE TYPE JOINTING KITS AND TERMINATIONS

1.0 This specification covers the design, manufacture, testing and supply and Heat Shrinkable type, Premoulded type, Cold shrinkable type, Tapex type, Jointing and termination kits suitable for XLPE and PILC Cables manufactured in general conformity to the standards published by Bureau of Indian Standards, New Delhi.

1.1 The purchaser reserves the right to place orders for any type of terminations/joints.

2.0 The tenderers shall furnish in the tender the type and complete technical details of joints/terminations offered with dimensional drawings, materials, literature, type test certifications from recognized test houses/institutions failing which the offers are liable to the rejected.

3.0 The tenderers should furnish details of similar kits supplied to Electricity Boards and Electricity Utilities and performance certifications for a minimum period of three years.

4.0 The cable jointing kits/terminations are required for use on PILC/XLPE Cables, the details of which are as noted below:

1. Type	:	PILC/XLPE insulated conductor and insulation screened.
2. Voltage	:	11KV
3. Conductor	:	Circular Compacted Aluminium
4. No. of Cores & Cross Sectional area of conductor	:	Three Core – 95, 240 and 400 Sq.mm. Single Core – 1000 Sq.mm.
5. Armour	:	G.I. Round/Formed, Wire/Hard drawn, Aluminium wire.
6. Sheath	:	a) Lead alloy E. Sheathed in Case of PILC Cable. b) PVC Compound type ST-2 in case of XLPE Cable.
7. Installations	:	Directly buried in ground. .

5.0 **HEAT SHRINKABLE TYPE**:

5.1 The term 'Heat Shrinkable' refers to extruded or moulded – polymeric material which are cross linked to develop elastic memory and supplied in an expanded or otherwise deformed size and shape. Subsequent heating in an unconstrained state to a temperature above the shrink temperature results in the materials recovering or shrinking to its original shape.

5.2 Stress control and stress grading wherever necessary in the termination and joint shall be by means of semi conducting heat shrinkable tubing.

5.3 Environmental sealing between the heat shrinkable materials and cable surfaces shall be achieved by using hot melted sealants or adhesives. Where such sealants or adhesives are exposed to high electrical stress, they must be track resistant. The adhesive or sealant used in the joint/terminations should not permit any entry of moisture into the joint/termination.

5.4 The external covering of insulated cores for terminations shall be by means of modified silicon heat shrinkable tubing's, which have non tracking and erosion resistant properties. The purchaser reserves the right to insist on checking the tracking resistance property of the non tracking materials.

6.0 **PREMOULDED TYPE (XLPE CABLE)**:

6.1 The term permoulded refers to of pre manufactured work-tested parts of a termination or joint of moulded Ethylene Propylene Diane Monomer (i.e. EPDM) rubber or silicone Rubber components with non tracking and erosion resistant properties.

6.2 The stress control and stress grading components/material wherever necessary in the terminations and joints shall be highly track resistant insulating section vulcanized to a semi conducting section.

6.3 Interface between the premoulded stress control/grading – component screen material and cable surface shall be achieved by semi conducting material which has cold flow properties. The design should climinate voids/air packets at the interface and discharge at the cable screen edges.

6.4 The stress cone must be of proven design for stress control. The semi conducting portion of ht stress cone should be vulcanized with insulation so that both semi conducting and insulation portion becomes an integrated part.

6.5 Environment sealing and to prevent ingress of moisture – between premoulded components and cable surface/end shall be provided with compatible component/device.

7.0 **TRANSITION JOINTS**:

In this specification the transition joint is defined as a straight through cable joint between two cables of different designs. The construction of the two cables to be joined, differ in insulation material, water barriers and configuration of cores, and stress distribution.

The transition joint is intended to be used between two cable 11 KV Grade, 3 core of following description.

1. Paper insulated, Mind, Lead Covered, Double steel tape/round wire armoured of either belted or screened design. The conductor is Aluminium with stranded sector shape or stranded circular shape.

2. Cross linked polyethylene insulated cables of screened type with formed wire or round wire Armour, with PVC jacket. The conductor is Aluminium circular, compacted, generally the sizes of the conductor are 95, 240 and 400 Sq.mm.

7.1 **Design Requirements**:

The joint must be capable of meeting the performance requirements of both the PILC and XLPE cables. The design must ensure that any interaction between the jointing – materials and the cable materials are not detrimental to either the performance of the transition joint or the cables to be joined.

i) STRESS CONTROL
The design of transition joint must control and limit high electrical stress and prevent discharges which occur at.

a) The termination (cut) of the lead sheath or earth envelop in a three core belated cable.

b) At the screen cut back in a screened cable.

c) In the area of conductor connection (Ferrule/connector).

ii) CONTENT OF PAPER IMPREGNANT
The design should ensure that there will be no contact between impregnant of the paper cable and the insulating and screening materials on the XLPE side of the joint. The transition joint must be capable of totally eliminating any migration of the impregnant form the MI/MIND cable to XLPE cable.

iii) The transition joint must provide for continuation of armour/ earth continuity. The fault current carrying capacity of the earth/armour continuity must not be less than that provided on the cables being joined.

iv) The transition joint must be provided with a strong over-all cover for a protection to prevent ingress of moisture in to the joint.

8.0 **TAPEX TYPE SYSTEM**:

8.1 The term Tapex refers to the kits using self amalgamation/self vulcanizing insulation tape made of EPDM Rubber/EPR Tapes and Non linear stress grading material for stress control.

8.2 The stress control shall be by means of non liner resistance material.

8.3 The joints and terminations shall met the requirement of class 1 accuracy of IEEE-48.

8.4 The stress grading material shall be wrapped around the cable core, overlapping the edge of the outer conducting layer. The top layers shall fuse together to form a compact rubber body around the stress grading material and cable core thereby exert on active pressure on cable.

8.5 DESIGN REQUIREMENTS:

The joints and terminations shall provide the following performance function:

a) Electric Stress Control between the semi conducting screens and over the ferrule.

b) Reinstatement of cable insulation.

c) Environmental and moisture sealing.

d) Mechanical strength and protection.

e) The tapes shall be self amalgamating/self vulcanizing having Antitracking, Corona, Ozone and UV light resistant.

f) The joints and terminations shall not require penciling of insulation and preparation of semi conducting screen at right angles or evenly.

9.0 **REQUIREMENTS**:

The Heat Shrinkable Type/Premoulded Type/Tapex Type/Straight Through Joints, Transition Joints, Indoor and Outdoor Terminations shall be suitable for 11KV, XLPE and PILC Underground Cable of sizes.

a) 3 Core x 95 Sq.mm.
b) 3 Core x 240 Sq.mm.
c) 3 Core x 400 Sq.mm.
d) 1 Core x 1000 Sq.mm.

9.1 The approximate total requirement of jointing kits and terminations of various sizes are as per Annexure.

9.2 The quantity shown is only approximate and is subject to increase or decrease depending on the actual requirement.

10.0 **SERVICE CONDITIONS**:

10.1 The straight through joint transition joints shall be suitable for use with cables which are directly buried in ground.

10.2 The indoor terminations shall be suitable for use in switchgear designed for both Indoor and Outdoor installation.

10.3 The outdoor terminations shall be suitable for use in directly exposed atmospheric conditions.

11.0 **POWER SYSTEM PARTICULARS**:

1. System voltage	:	11 KV
2. Highest voltage	:	12 KV
3. Neutral	:	Effectively earthed
4. Frequency	:	50 HZ + OR - 3%
5. CSA of conductor	:	3 core 95 to 400 Sq.mm. Aluminium 1 core 1000 Sq.mm. Aluminium
6. Rated Current at 90°C	:	3 Core 195 to 410 Amps 1 Core 740 Amps.

12.0 **CLIMATIC CONDITIONS**:

a. Site locations	:	Various sites in Karnataka State.
b. Altitude	:	Not exceeding 1000M above sea level.
c. Ambient Temp.	:	50°C Max. 5°C Min.
d. Relative Humidity	:	100% Max. 10% Min.
e. Rainfall	:	As per Indian Monsoon.

13.0 **STANDARDS**:

13.1 The testing of the completed system of joints and terminations shall be in accordance with the following standards, with latest amendments.

a) IS 13573: Joints and terminations of polymeric cables for working voltages from 6.6 KV upto & including 33 KV performance requirements and type tests.

b) VDE 0278 Power Cables accessories with rated voltage upto 30KV.

The other applicable standards for testing of accessories and material properties of document shall be:

i) IS 7098 Part (2) – 1985: Cross linked polyethylene insulated PVC sheathed cables.

ii) IEC 60502 – Extruded solid dielectric power cables for rated voltages from 1 KV upto 30 KV.

iii) ISI 0913 – Electricity supply industry (Electricity Technical Association) performance specification for high voltage heat shrinkable components for use with high voltage solid type cables Upto and including 33KV.

iv) IEEE 48 – Test procedures and requirements for high voltage alternating current cable terminations.

v) ISO-R 37 – determination of tensile stress strain properties of vulcanized rubbers.

vi) ASTM – D – 2303 liquid contaminant inclined plane tracking and erosion test.

vii) IEC 60243 recommended method of test for electric strength of solid insulating materials at power frequencies.

14.0 **DESIGN REQUIREMENTS**:

a) **Joints**: The joint shall provide for the following performance functions.

i) Electric stress control between the cable semi-conducting screens and over the ferrule.
ii) Reinstatement of cable insulation.
iii) Environmental protection and moisture sealing.
iv) Mechanical strength and protection.

b) **Terminations**: The terminations shall be designed to provide.

i) Electric stress control for the cable insulation shield terminus.

ii) Complete external leakage insulation between the cable conductor/conductors and earth.

iii) Seal to the end of the cable against the entrance of external environment.

c) The joints and terminations in the form of completed system shall meet the type test requirements as per the standards:

i) IS 13573 } with latest amendments
ii) VDE 0278 }

15.0 **TESTS**:

15.1 Routine Tests:

a) Visual inspection.
b) Dimensional check.
c) Physical verification of kit contents as per bill of material.

15.2 Acceptance Tests:

a) Tensile strength for tubings.
b) Ultimate elongation test for tubings.
c) Longitudinal shrinkage.

The above tests shall be conducted on samples selected at random from each lot of supply, at suppliers works or a reputed test house at suppliers costs.

15.3 **Type Test:**

The successful bidder shall arrange at his own cost for conducting of type test on a completed system, at a reputed test house. The samples for such tests will be selected at random by the purchaser out of supplies offered. The tests will be witnessed by the representative of the purchaser. The type tests to be conducted shall be as prescribed in IS 13573 – or equivalent standards.

16.0 **TEST CERTIFICATE**:

16.1 The material offered shall be fully type tested as per relevant standards and the tenderer shall furnish type test reports from CPRI, Bangalore or VDE test certificates from any National/International test house.

16.2 For any change in the design/type already type tested and the design/ type offered against this specification, the purchaser will draw a sample from the supplies and the type test on these will be carried out by the supplier at his cost. In case the material/system fails in the type test the entire lot will be rejected.

16.3 The purchaser reserves the right to demand repetition of some or all the type tests in the presence of purchaser's representative.

17.0 **DRAWINGS**:

The tenderer shall furnish the dimensional drawing of the joints and terminations offered.

18.0 **GUARANTEED TECHNICAL PARTICULARS**:

The guaranteed technical particulars of the joints/terminations offered shall be furnished by the tenderer.

19.0 **TESTING FACILITY**:

The bidder shall furnish the details of manufacturing and testing facilities available with him and the address of their test houses where manufacturing and testing will be carried out.

20.0 **INSPECT AND TESTING**:

20.1 In respect of components like tubings, mouldings and sealants the bidder shall furnish the proof of source of supply, manufacture test reports and quality assurance reports along with the bid, against past supplies similar documents shall be made available in respect of this order during inspection s and testing.

20.2 The supplier shall tender necessary assistance in inspection and for witnessing of testing at his work/test house.

21.0 **QUALITY ASSURANCE**:

The bidder shall invariably furnish the following information along with the offer. The information shall be separately given for individual components of the system offered, failing which the offer will be rejected.

i) Statement giving list of important components, auxiliaries, source of supply of raw materials, list of standards according to which the materials are tested, list of tests carried out on materials, test reports under type approval and quality assurance.

ii) List of areas in manufacturing process where stage inspections are normally carried out from quality control and details of such tests and inspections.

iii) The quality assurance plan with hold points for owners inspection. The quality assurance plan and owners hold points shall be discussed between the owner and contractor before the QAP is finalized

iv) The supplier shall furnish the routine test certificates of bought out accessories and central excise gate pass for imported items during inspection.

22.0 **DEVIATION**:

Any deviation from the specifications shall be setout clause by clause by the tenderer in a separate sheet titled "Technical Deviations".

23.0 **BILL OF MATERIALS/KIT CONTENTS**:

23.1 Each jointing/termination kit supplied as a single kit shall be self sufficient and contain all necessary electrical/mechanical components for making a complete joint/termination. There shall be absolutely no necessity of any additional material/component, except the contents supplied in the kit for making the joint/termination. Terminal lugs shall be of copper only.

23.2 The bid shall accompany with detailed list of kit contents/bill of materials, describing the component, quantity, material of component, dimensions size, weights lengths of tubings etc.

23.3 All the kit contents shall have unlimited life for storage in Indian conditions.

23.4 Any components which has a specific shelf life, the component should be stamped with date of manufacturing and the expiry date.

24.0 **PACKING AND MARKING**:

24.1 All components pertaining to a joint or termination shall be packed in a strong separate cardboard carton with each component sealed and labeled.

24.2 The package shall be marked with the name of the manufacturer, supplier, type designation, and relevant technical information along with address of consignee the details of consignment batch No., bill of materials for each package.

25.0 **LIST OF DOCUMENTS TO BE FURNISHED WITH THE BID**:

25.1 (i) Technical Brochure
(ii) Drawings
(iii) Installation Instructions
(iv) Type test reports on complete (joint and termination) system and the components
(v) Quality assurance plan
(vi) Supply record, clearly indicating the address of the purchaser, order reference, material supplied, voltage class, quantity and date of supply.
(vii) Test report literature, brochure of bought out items.
(viii) Performance reports/certifications from customers.

26.0 **GUARANTEE**:

26.1 The jointing kits and terminations shall be guaranteed for satisfactory and trouble free operation for a period of five years from the date of supply against defects in the materials or design.

26.2 In case of failure within the guaranteed period due to faulty design and defective materials, and on such information to the supplier the jointing/termination kit will be replaced free of cost by the supplier within a period of 3 months from the date of intimation by the purchaser.

27.0 **TRAINING**:

The successful bidder shall arrange for training of purchaser's Engineers at any two places of choice in BESCOM. The kit will be supplied by the purchaser.

General Manager El.,
Procurement, BESCOM.

TECHNICAL SPECIFICATION FOR HEAT SHRINKABLE TYPE, TAPE X TYPE, PRE MOULDED TYPE AND COLD SHRINKABLE TYPE JOINTING KITS AND TERMINATIONS

1.0 This specification covers the design, manufacture, testing and supply and Heat Shrinkable type, Premoulded type, Cold shrinkable type, Tapex type, Jointing and termination kits suitable for XLPE and PILC Cables manufactured in general conformity to the standards published by Bureau of Indian Standards, New Delhi.

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3.0 The tenderers should furnish details of similar kits supplied to Electricity Boards and Electricity Utilities and performance certifications for a minimum period of three years.

4.0 The cable jointing kits/terminations are required for use on PILC/XLPE Cables, the details of which are as noted below:

1. Type	:	PILC/XLPE insulated conductor and insulation screened.
2. Voltage	:	11KV
3. Conductor	:	Circular Compacted Aluminium
4. No. of Cores & Cross Sectional area of conductor	:	Three Core – 95, 240 and 400 Sq.mm. Single Core – 1000 Sq.mm.
5. Armour	:	G.I. Round/Formed, Wire/Hard drawn, Aluminium wire.
6. Sheath	:	a) Lead alloy E. Sheathed in Case of PILC Cable. b) PVC Compound type ST-2 in case of XLPE Cable.
7. Installations	:	Directly buried in ground. .

5.0 **HEAT SHRINKABLE TYPE**:

5.1 The term 'Heat Shrinkable' refers to extruded or moulded – polymeric material which are cross linked to develop elastic memory and supplied in an expanded or otherwise deformed size and shape. Subsequent heating in an unconstrained state to a temperature above the shrink temperature results in the materials recovering or shrinking to its original shape.

5.2 Stress control and stress grading wherever necessary in the termination and joint shall be by means of semi conducting heat shrinkable tubing.

5.3 Environmental sealing between the heat shrinkable materials and cable surfaces shall be achieved by using hot melted sealants or adhesives. Where such sealants or adhesives are exposed to high electrical stress, they must be track resistant. The adhesive or sealant used in the joint/terminations should not permit any entry of moisture into the joint/termination.

5.4 The external covering of insulated cores for terminations shall be by means of modified silicon heat shrinkable tubing's, which have non tracking and erosion resistant properties. The purchaser reserves the right to insist on checking the tracking resistance property of the non tracking materials.

6.0 **PREMOULDED TYPE (XLPE CABLE)**:

6.1 The term permoulded refers to of pre manufactured work-tested parts of a termination or joint of moulded Ethylene Propylene Diane Monomer (i.e. EPDM) rubber or silicone Rubber components with non tracking and erosion resistant properties.

6.2 The stress control and stress grading components/material wherever necessary in the terminations and joints shall be highly track resistant insulating section vulcanized to a semi conducting section.

6.3 Interface between the premoulded stress control/grading – component screen material and cable surface shall be achieved by semi conducting material which has cold flow properties. The design should climinate voids/air packets at the interface and discharge at the cable screen edges.

6.4 The stress cone must be of proven design for stress control. The semi conducting portion of ht stress cone should be vulcanized with insulation so that both semi conducting and insulation portion becomes an integrated part.

6.5 Environment sealing and to prevent ingress of moisture – between premoulded components and cable surface/end shall be provided with compatible component/device.

7.0 **TRANSITION JOINTS**:

In this specification the transition joint is defined as a straight through cable joint between two cables of different designs. The construction of the two cables to be joined, differ in insulation material, water barriers and configuration of cores, and stress distribution.

The transition joint is intended to be used between two cable 11 KV Grade, 3 core of following description.

1. Paper insulated, Mind, Lead Covered, Double steel tape/round wire armoured of either belted or screened design. The conductor is Aluminium with stranded sector shape or stranded circular shape.

2. Cross linked polyethylene insulated cables of screened type with formed wire or round wire Armour, with PVC jacket. The conductor is Aluminium circular, compacted, generally the sizes of the conductor are 95, 240 and 400 Sq.mm.

7.1 **Design Requirements**:

The joint must be capable of meeting the performance requirements of both the PILC and XLPE cables. The design must ensure that any interaction between the jointing – materials and the cable materials are not detrimental to either the performance of the transition joint or the cables to be joined.

i) STRESS CONTROL
The design of transition joint must control and limit high electrical stress and prevent discharges which occur at.

a) The termination (cut) of the lead sheath or earth envelop in a three core belated cable.

b) At the screen cut back in a screened cable.

c) In the area of conductor connection (Ferrule/connector).

ii) CONTENT OF PAPER IMPREGNANT
The design should ensure that there will be no contact between impregnant of the paper cable and the insulating and screening materials on the XLPE side of the joint. The transition joint must be capable of totally eliminating any migration of the impregnant form the MI/MIND cable to XLPE cable.

iii) The transition joint must provide for continuation of armour/ earth continuity. The fault current carrying capacity of the earth/armour continuity must not be less than that provided on the cables being joined.

iv) The transition joint must be provided with a strong over-all cover for a protection to prevent ingress of moisture in to the joint.

8.0 **TAPEX TYPE SYSTEM**:

8.1 The term Tapex refers to the kits using self amalgamation/self vulcanizing insulation tape made of EPDM Rubber/EPR Tapes and Non linear stress grading material for stress control.

8.2 The stress control shall be by means of non liner resistance material.

8.3 The joints and terminations shall met the requirement of class 1 accuracy of IEEE-48.

8.4 The stress grading material shall be wrapped around the cable core, overlapping the edge of the outer conducting layer. The top layers shall fuse together to form a compact rubber body around the stress grading material and cable core thereby exert on active pressure on cable.

8.5 DESIGN REQUIREMENTS:

The joints and terminations shall provide the following performance function:

a) Electric Stress Control between the semi conducting screens and over the ferrule.

b) Reinstatement of cable insulation.

c) Environmental and moisture sealing.

d) Mechanical strength and protection.

e) The tapes shall be self amalgamating/self vulcanizing having Antitracking, Corona, Ozone and UV light resistant.

f) The joints and terminations shall not require penciling of insulation and preparation of semi conducting screen at right angles or evenly.

9.0 **REQUIREMENTS**:

The Heat Shrinkable Type/Premoulded Type/Tapex Type/Straight Through Joints, Transition Joints, Indoor and Outdoor Terminations shall be suitable for 11KV, XLPE and PILC Underground Cable of sizes.

a) 3 Core x 95 Sq.mm.
b) 3 Core x 240 Sq.mm.
c) 3 Core x 400 Sq.mm.
d) 1 Core x 1000 Sq.mm.

9.1 The approximate total requirement of jointing kits and terminations of various sizes are as per Annexure.

9.2 The quantity shown is only approximate and is subject to increase or decrease depending on the actual requirement.

10.0 **SERVICE CONDITIONS**:

10.1 The straight through joint transition joints shall be suitable for use with cables which are directly buried in ground.

10.2 The indoor terminations shall be suitable for use in switchgear designed for both Indoor and Outdoor installation.

10.3 The outdoor terminations shall be suitable for use in directly exposed atmospheric conditions.

11.0 **POWER SYSTEM PARTICULARS**:

1. System voltage	:	11 KV
2. Highest voltage	:	12 KV
3. Neutral	:	Effectively earthed
4. Frequency	:	50 HZ + OR - 3%
5. CSA of conductor	:	3 core 95 to 400 Sq.mm. Aluminium 1 core 1000 Sq.mm. Aluminium
6. Rated Current at 90°C	:	3 Core 195 to 410 Amps 1 Core 740 Amps.

12.0 **CLIMATIC CONDITIONS**:

a. Site locations	:	Various sites in Karnataka State.
b. Altitude	:	Not exceeding 1000M above sea level.
c. Ambient Temp.	:	50°C Max. 5°C Min.
d. Relative Humidity	:	100% Max. 10% Min.
e. Rainfall	:	As per Indian Monsoon.

13.0 **STANDARDS**:

13.1 The testing of the completed system of joints and terminations shall be in accordance with the following standards, with latest amendments.

a) IS 13573: Joints and terminations of polymeric cables for working voltages from 6.6 KV upto & including 33 KV performance requirements and type tests.

b) VDE 0278 Power Cables accessories with rated voltage upto 30KV.

The other applicable standards for testing of accessories and material properties of document shall be:

i) IS 7098 Part (2) – 1985: Cross linked polyethylene insulated PVC sheathed cables.

ii) IEC 60502 – Extruded solid dielectric power cables for rated voltages from 1 KV upto 30 KV.

iii) ISI 0913 – Electricity supply industry (Electricity Technical Association) performance specification for high voltage heat shrinkable components for use with high voltage solid type cables Upto and including 33KV.

iv) IEEE 48 – Test procedures and requirements for high voltage alternating current cable terminations.

v) ISO-R 37 – determination of tensile stress strain properties of vulcanized rubbers.

vi) ASTM – D – 2303 liquid contaminant inclined plane tracking and erosion test.

vii) IEC 60243 recommended method of test for electric strength of solid insulating materials at power frequencies.

14.0 **DESIGN REQUIREMENTS**:

a) **Joints**: The joint shall provide for the following performance functions.

i) Electric stress control between the cable semi-conducting screens and over the ferrule.
ii) Reinstatement of cable insulation.
iii) Environmental protection and moisture sealing.
iv) Mechanical strength and protection.

b) **Terminations**: The terminations shall be designed to provide.

i) Electric stress control for the cable insulation shield terminus.

ii) Complete external leakage insulation between the cable conductor/conductors and earth.

iii) Seal to the end of the cable against the entrance of external environment.

c) The joints and terminations in the form of completed system shall meet the type test requirements as per the standards:

i) IS 13573 } with latest amendments
ii) VDE 0278 }

15.0 **TESTS**:

15.1 Routine Tests:

a) Visual inspection.
b) Dimensional check.
c) Physical verification of kit contents as per bill of material.

15.2 Acceptance Tests:

a) Tensile strength for tubings.
b) Ultimate elongation test for tubings.
c) Longitudinal shrinkage.

The above tests shall be conducted on samples selected at random from each lot of supply, at suppliers works or a reputed test house at suppliers costs.

15.3 **Type Test:**

The successful bidder shall arrange at his own cost for conducting of type test on a completed system, at a reputed test house. The samples for such tests will be selected at random by the purchaser out of supplies offered. The tests will be witnessed by the representative of the purchaser. The type tests to be conducted shall be as prescribed in IS 13573 – or equivalent standards.

16.0 **TEST CERTIFICATE**:

16.1 The material offered shall be fully type tested as per relevant standards and the tenderer shall furnish type test reports from CPRI, Bangalore or VDE test certificates from any National/International test house.

16.2 For any change in the design/type already type tested and the design/ type offered against this specification, the purchaser will draw a sample from the supplies and the type test on these will be carried out by the supplier at his cost. In case the material/system fails in the type test the entire lot will be rejected.

16.3 The purchaser reserves the right to demand repetition of some or all the type tests in the presence of purchaser's representative.

17.0 **DRAWINGS**:

The tenderer shall furnish the dimensional drawing of the joints and terminations offered.

18.0 **GUARANTEED TECHNICAL PARTICULARS**:

The guaranteed technical particulars of the joints/terminations offered shall be furnished by the tenderer.

19.0 **TESTING FACILITY**:

The bidder shall furnish the details of manufacturing and testing facilities available with him and the address of their test houses where manufacturing and testing will be carried out.

20.0 **INSPECT AND TESTING**:

20.1 In respect of components like tubings, mouldings and sealants the bidder shall furnish the proof of source of supply, manufacture test reports and quality assurance reports along with the bid, against past supplies similar documents shall be made available in respect of this order during inspection s and testing.

20.2 The supplier shall tender necessary assistance in inspection and for witnessing of testing at his work/test house.

21.0 **QUALITY ASSURANCE**:

The bidder shall invariably furnish the following information along with the offer. The information shall be separately given for individual components of the system offered, failing which the offer will be rejected.

i) Statement giving list of important components, auxiliaries, source of supply of raw materials, list of standards according to which the materials are tested, list of tests carried out on materials, test reports under type approval and quality assurance.

ii) List of areas in manufacturing process where stage inspections are normally carried out from quality control and details of such tests and inspections.

iii) The quality assurance plan with hold points for owners inspection. The quality assurance plan and owners hold points shall be discussed between the owner and contractor before the QAP is finalized

iv) The supplier shall furnish the routine test certificates of bought out accessories and central excise gate pass for imported items during inspection.

22.0 **DEVIATION**:

Any deviation from the specifications shall be setout clause by clause by the tenderer in a separate sheet titled "Technical Deviations".

23.0 **BILL OF MATERIALS/KIT CONTENTS**:

23.1 Each jointing/termination kit supplied as a single kit shall be self sufficient and contain all necessary electrical/mechanical components for making a complete joint/termination. There shall be absolutely no necessity of any additional material/component, except the contents supplied in the kit for making the joint/termination. Terminal lugs shall be of copper only.

23.2 The bid shall accompany with detailed list of kit contents/bill of materials, describing the component, quantity, material of component, dimensions size, weights lengths of tubings etc.

23.3 All the kit contents shall have unlimited life for storage in Indian conditions.

23.4 Any components which has a specific shelf life, the component should be stamped with date of manufacturing and the expiry date.

24.0 **PACKING AND MARKING**:

24.1 All components pertaining to a joint or termination shall be packed in a strong separate cardboard carton with each component sealed and labeled.

24.2 The package shall be marked with the name of the manufacturer, supplier, type designation, and relevant technical information along with address of consignee the details of consignment batch No., bill of materials for each package.

25.0 **LIST OF DOCUMENTS TO BE FURNISHED WITH THE BID**:

25.1 (i) Technical Brochure
(ii) Drawings
(iii) Installation Instructions
(iv) Type test reports on complete (joint and termination) system and the components
(v) Quality assurance plan
(vi) Supply record, clearly indicating the address of the purchaser, order reference, material supplied, voltage class, quantity and date of supply.
(vii) Test report literature, brochure of bought out items.
(viii) Performance reports/certifications from customers.

26.0 **GUARANTEE**:

26.1 The jointing kits and terminations shall be guaranteed for satisfactory and trouble free operation for a period of five years from the date of supply against defects in the materials or design.

26.2 In case of failure within the guaranteed period due to faulty design and defective materials, and on such information to the supplier the jointing/termination kit will be replaced free of cost by the supplier within a period of 3 months from the date of intimation by the purchaser.

27.0 **TRAINING**:

The successful bidder shall arrange for training of purchaser's Engineers at any two places of choice in BESCOM. The kit will be supplied by the purchaser.

General Manager El.,
Procurement, BESCOM.

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TECHNICAL SPECIFICATION FOR 3 PHASE, 4 WIRE A.C. STATIC L.T. TRIVECTOR METER WITH TOD FACILITY AND DLMS ICS COMPLIANT, 5A, 240V (415V), CATEGORY-A FOR DISTRIBUTION TRANSFORMER AND CATEGORY-C FOR CONSUMER METERING APPLICATION.

1. SCOPE :

(i) This specification covers the design, manufacture, testing before despatch, supply and random testing after delivery of ISI-marked of class 0.5S accuracy static LT Trivector Meters for consumer metering/Distribution transformer metering purpose as per requirement given in this specification. The meter should be 3 phase 4 wire CT/PT operated fully static and AMR Compatible Trivector Energy meter type. The meter should be capable to record and display active, reactive, apparent and maximum demand in apparent for 3 phase 4 wire AC balanced/unbalanced loads for a power factor range of zero (lagging), unity and zero (leading) as per requirement given in this specification. Meters shall be supplied along with base-computer software's (BCS) as per the details given in this specification.

(ii) It is not the intent to specify completely herein all the details of the design and construction of material. The material shall, however, conform in all respects to high standards of engineering, design and workmanship and shall be capable of performing for continuous commercial operation in a manner acceptable to the purchaser.

2. STANDARDS APPLICABLE :

Unless otherwise specified elsewhere in this specification, the performance and testing of the meters shall conform to the following Indian/International Standards and all related Indian/International standards to be read with upto-date and latest amendments/revisions thereof:

Sr. No.	Standard No.	Title
1	IS 14697-1999	AC Static Transformer Operated Watt-hour and VAR-Hour Meters, class 0.2S & 0.5S.
2	CBIP, New Delhi Guide No 325: 2015.	Specification for AC Static Electrical Energy Meters
3.	CBIP Technical report no. 111	Specification for common Meter Reading Instrument
4.	IEC-62052-11-	Electricity metering equipments (AC)- General Requirements & test conditions Part 11. metering equipments
5.	IS :9000	Basic Environmental Testing Procedures for Electronic & Electrical Items.
6.	ICS-BIS-ETD 13-6211-APR2010	Indian companion standard as applicable.
7	IS 15959:2011 (with latest amendments)	Data exchange for electricity meter reading, tariff and load control-ICS (DLMS)
8	IEC 62053-22	Electricity Metering equipment AC Part-22-static meter for active energy (Classes 0.2s

		and 0.5s)
9	IEC 62056-21	Electricity metering - Data exchange for meter reading, tariff and load control. Part 21: Direct local data exchange.

Meters matching with requirements of other national or international standards, which ensure equal or better performance along with the standards mentioned above, shall also be considered. When the equipment offered by the tenderer conforms to standards those specified above, salient points of difference between standards adopted and the standards specified in this specification shall be clearly brought out in the relevant schedule and copy of such standards along with their English translation shall invariably be furnished along with the offer.

3. General Technical Requirements :

1	TYPE	AMR Compatible Static, 3 Ph 4 Wire Electronic Trivector Energy Meter
2	FREQUENCY	50 Hz ±5%
3	ACCURACY CLASS	0.5S
4	SECONDARY VOLTAGE	Suitable for operation from 415V Ph-Ph/or 240 V Ph-N
5	BASIC CURRENT (Ib)	-/5 Amps.
6	MAXIMUM CONTINUOUS CURRENT	2.0 Ib; Starting and Short time current shall be as per IS-14697
7	POWER CONSUMPTION	i) The active and apparent power consumption, in each voltage circuit, at reference voltage, reference temperature and reference frequency shall not exceed 1. 5 W and 8 VA. ii) The apparent power taken by each current circuit, at basic current, reference frequency and reference temperature shall not exceed 1.0 VA
8	POWER FACTOR	0.0 Lag -Unity- 0.0 Lead

4. DESIGN:

Meter shall be designed with application specific integrated circuit (ASIC) or micro controller; shall have no moving part; electronic components shall be assembled on printed circuit board using surface mounting technology; factory calibration using high accuracy (0.05 class) software based test bench.

5. CLIMATIC CONDITIONS:

As per IS 14697-1999 (reaffirmed 2004) meter to perform satisfactorily under non air conditioned environment (within stipulation of IS).

Meter body will confirm to IP 51 degree of protection. For outdoor use meter shall be installed in sealed enclosure conforming to IP 55.

The meters shall be suitably designed and treated for normal life and satisfactory operation under the hot and hazardous tropical climate conditions and shall be

dust and vermin proof. All the parts and surfaces which are subjected to corrosion shall either be made of such material or shall be provided with such protective finish which provides suitable protection to them from any injuries effect of excessive humidity. The meter shall be required to operate satisfactorily and continuously under the following tropical climatic conditions:

i)	Temperature	4° C to 55°C (45°C in shade)
ii)	Relative Humidity	45% - 95% (Sometimes approaches to saturation)
iii)	Average annual rainfall	3000 mm
iv)	Max. wind pressure	150 Kg per Sq. mm
v)	Max. altitude	1000 meters.
vi)	Average No. of dust-storm days per annum	40 days
vii)	Average no. of rainy days per annum	90 days
viii)	No. of months of tropical Monsoon conditions per Annum	3 months
ix)	**Isoceraunic level**	56 days

Extra precaution in Meter manufacturing shall be taken while designing the meter considering Isoceraunic level in the BESCOM areas for preventing failure of meters due to lightning surges & high humidity during monsoon period.

6. SUPPLY SYSTEM :

Rated Voltage (Vref) 3 x 240 V - Phase to Neutral (3 phase 4 wire system)

3 x 415 V - Phase to Phase

Rated current (Ib) (Connected through CT) 3 x -/5 Amps

Multiplying factor to arrive at actual primary values wherever applicable shall be calculated from the CT ratio of the installed CTs i.e. meter shall read in secondary values of voltage and current.

7. POWER FACTOR RANGE :

The meter shall be suitable for full power factor range from zero (lagging) through unity to zero (leading).

8. POWER SUPPLY VARIATION :

The extreme power variation for which an operating meter should withstand without damage and without degradation of its metrological characteristics when it is subsequently operated under its normal operating conditions shall be as follows:

Specified operating range - 0.8 to 1.1 V ref.

Limit range of operation - 0.6 to 1.2 V ref.

The limits of error for voltage variation of +20% to - 40% of V ref shall be as under:

Influence Quantities		Value of current	Power Factor	Limits of variation in percentage error
				0.5S
i	Voltage variation between -40% to + 20%	Ib Ib	1 0.5 lag	**0.2** **0.4**
ii	10% of 3rd harmonic in current circuit	0.6Ib 0.6Imax	UPF UPF	0.1 0.1

Frequency -47.5 Hz to 52.5 Hz. (Reference frequency 50 Hz.)

However, the bidder can offer meters which can withstand higher variations. Meter shall be functional and able to register energy even if the voltage falls up to 50% of the rated voltage and 10% of Ib at UPF.

9. ACCURACY:

Class of accuracy of the meter shall be 0.5S. The accuracy should not drift with time.

10. POWER CONSUMPTION:

(i) Voltage circuit: The active and apparent power consumption in each voltage circuit including the power supply of meter at reference voltage, reference temperature and reference frequency shall not exceed 1.5W per phase and 8VA per phase respectively

ii) Current circuit: The apparent power taken by each current circuit at basic current, reference frequency and reference temperature shall not exceed 1 VA per phase.

11 STARTING CURRENT:

The meter should start registering the energy at 0.1% Ib and unity power factor.

12. MAXIMUM CURRENT:

The rated maximum current of the meter shall be 200% Ib.

13. GENERAL AND CONSTRUCTIONAL REQUIREMENTS:

i) Meters shall be designed and constructed in such a way so as to avoid causing any danger during use and under normal conditions. However the following should be ensured :-

a) Personnel safety against electric shock
b) Personnel safety against effects of excessive temperature.
c) Protection against spread of fire.
d) Protection against penetration of solid objects, dust and water.

ii) All the materials and electronic power components used in the manufacture of the meter shall be of highest quality and reputed make to ensure higher reliability, longer life and sustained accuracy.

iii) The meter shall be designed with application specific integrated circuits. The electronic components shall be mounted on the printed circuit board using latest Surface Mount Technology (SMT).

iv) All insulating materials used in the construction of meters shall be non- hygroscopic, non-aging and of tested quality.
All parts that are likely to develop corrosion shall be effectively protected against corrosion by providing suitable protective coating.

v) The meter shall have an operation indication device such as a blinking LED/LCD. The operation indicator shall be visible from the front window.

vi) The meter shall conform to the degree of protection IP 51 of IS 12063/IEC: 529 for protection against ingress of dust, moisture and vermins.

vii) The meter shall be supplied with a transparent extended terminal-block cover (ETBC).

viii) The meter-base, meter-cover, terminal block and ETBC shall be made of unbreakable, high grade, fire- resistant, reinforced, non-inflammable, high-grade and good quality engineering plastic.

ix) The meter-cover shall be of transparent, UV stabilized polycarbonate *(shall confirm to IS 11731 FH 1 Category besides meeting the test requirement of heat deflection test as per ISO 75, Glow wire test as per IS 11000 part 2/Sec-1-1984 or IEC PUB,60695-2-12, Ball pressure test as per IEC 60695-10-2 & Flammability test as per UL 94 or as per IS 11731 part 2 1986)* or equivalent high grade engineering plastic for easily reading all the displayed values/parameters, name plate details and observation of operation indicator.

x) The terminal block, the ETBC and the meter case shall ensure reasonable safety against the spread of fire and should not be ignited by thermic overload of live parts in contact with them.

xi) The terminal block shall be of high grade non-hygroscopic, fire-retardant, low-tracking, fire-resistant, high grade engineering plastic.

xii) The meter shall have nickel-plated brass terminals. The terminals shall have suitable construction with barriers and cover to provide firm and safe connection of current and voltage leads of stranded copper conductors with copper reducer type terminal ends (thimbles).

xiii) The manner of fixing the conductors to the terminal block shall ensure adequate and durable contact such that there is no risk of loosening or undue heating. Screw connections transmitting contact force and screw fixings which may be loosened and tightened several times during the life of the meter shall screw into a metal nut. All parts of each terminal shall be such that the risk of corrosion resulting from contact with any other metal part is minimized. Two screws shall be provided in each current terminal for effectively clamping the external leads or thimbles. Electrical connections shall be so designed that contact pressure is not transmitted through insulating material. The internal diameter of the terminal holes shall be minimum 5.0 mm. The clearances and creepage distances shall conform to clause 6.6 of IS 14697:1999.

xiv) The meter shall be compact in design. The entire design and construction shall be capable of withstanding stresses likely to occur in actual service and rough handling during transportation. The meter shall be convenient to transport and immune to shock and vibrations during transportation and handling.

14. MANUFACTURING PROCESS, ASSEMBLY & TESTING:-

Meters shall be manufactured using latest & 'State of the Art' technology & methods prevalent in electronics industry. The meter shall be made from High Accuracy & reliable surface mount technology (SMT) components. All inward flow of major component & sub assembly parts (CT, PT, RTCs/Crystal, LCDs Power circuit electronic component etc shall have batch and source identification. Multilayer 'PCB' assembly 'PTH' (plated through hole) using surface mounted component shall have adequate track clearance for power circuits. SMT component shall be assembled using automatic 'pick-and-place' machines, Reflow Soldering oven, for stabilized setting of the components on 'PCB' for soldered PCBs, cleaning and washing of cards, after wave soldering process is to be carried out as a standard practice. Assembly line of the manufacturing system shall have provision for testing of sub-assembled cards. Manual placing of components and soldering, to be minimized to items, which cannot be handled by automatic machine. Handling of 'PCB' with ICs/C-MOS components , to be restricted to bare minimum and precautions to prevent 'ESD' failure to be provided. Complete assembled and soldered PCB should undergo functional testing using computerized Automatic Test Equipment.

Fully assembled and finished meter shall undergo 'burn-in' test process for 12 hrs at 55 degree Celsius (Max. temperature not to exceed 60 degree Celsius) under base current (Ib) load condition.

Test points should be provided to check the performance of each block/stage of the meter circuitry. RTC shall be synchronized with NPL time at the time of manufacture. Meters testing at intermediate and final stage shall be carried

out with testing instruments, duly calibrated with reference standard, with traceability of source and date.

15. SEALING OF THE METER:

The meter shall be factory calibrated and sealed suitably before dispatch.
Good quality seals should have six digits non repeated numbers with embossing on both sides - one side with the logo of the manufacturer and the on the other side the logo of the concerned ESCOM. Only patented seals (seals from the manufacturer who has official right to manufacture the seal) shall be used. Seals can with stand up to 270 deg C, so that it can not be tampered by boiling like ordinary plastic seals. Two sealing screws shall be provided for proper sealing of the meter cover so that access to the internal part shall not be possible without breaking the seal.
Additionally, two sealing holes shall be provided on meter case suitable for inserting sealing wire of min. 2mm dia.
Two no. of sealing screws should also be provided to seal the terminal cover by the purchaser.
The above sealing inserting arrangement shall be integral part of moulded case. The provision of sealing shall also be integral part of the meter and the seals shall not be supplied loose with the meter.
A tracking and recording software for all new seals shall be provided by the manufacturer of the meter so as to track total movement of seals starting from manufacturing, procurement, storage, record keeping, installation, series of inspections, removal and disposal.

16. MARKING OF METER :

The meter terminal marking and mounting arrangement should be as per Indian installation practices.

The marking on every meter shall be in accordance with IS 14697-1999 .

Every meter shall have name plate beneath the meter cover such that the name plate cannot be accessed without opening the meter cover and without breaking the seals of the meter cover and the name plate shall be marked indelibly. The name plate marking should not fade or otherwise be adversely affected by UV exposure with lapse of time. The basic markings on the meter name plate shall be as follows: -

i. Manufacturer's name or trade mark and place of manufacture.
ii. Type Designation.
iii. Number of phases and wires.
iv. Serial number.
v. Month & year of manufacture with bar code.
vi. Reference voltage & frequency.
vii. Rated secondary current of CT (-/5 A).
viii. Principal unit(s) of measurement.
ix. Meter constant
x. Class index of meter.
xi. "Property of BESCOM".

xii. Purchase Order Number & Date.
xiii. Guarantee period- 5 years
xiv. IS and S mark
xv. Category Type
xvi. TOD Zone Timing

17. CONNECTION DIAGRAM & TERMINAL MARKINGS:

The connection diagram of the meter shall be indicated on inside portion of extended terminal block cover showing connections from CT's to meter. The meter terminals shall also be marked and this marking should appear in the above diagram.

18. SOFTWARES:

The BCS software shall be made available and shall be installed on BCS by the Supplier..

1) Software for reading, down loading data of the meter time, setting and TOD programming in the meter, normally resident in the Common Meter Reading Instrument (CMRI); The software shall be supplied separately in the form of CDs.

2) Windows based Basc Computer Software (BCS) for receiving data from CMRI and downloading instructions from base computer to CMRI. This BCS should have, amongst other requirements and features and facilities described later in this specification, the facility to convert meter-reading data into user definable ASCII file format.

19. SALIENT FEATURES:

The meter shall have the following additional salient features:

1. Additional indicators shall be provided on display to show healthiness of phase voltage.

2. Meter shall have Scroll Lock facility to display any one desired parameter continuously from display parameters.

3. The meter shall have provision to display & download data in **during power supply failure through an Internal battery/ Super Capacitor** as per provision of Annexure: G-14 of IS 14697-1999 such that it should not be possible to damage the circuitry of the meter by applying excess voltage directly in the meter.

4. The meter should work accurately irrespective of phase sequence of the mains supply.

5. The meter should remain powered up and functional even when either of any two phases or any one phase along with neutral is available to the meter.

6. The meter should continue to record accurately even if the neutral of potential supply gets disconnected.

7. The meter shall be provided with adequate magnetic shielding so that any external magnetic field (AC Electro Magnet or DC Magnet) as per the values specified in CBIP Technical Report **No.325** (with latest amendments) applied on the meter shall not affect the proper functioning and recording of energy as per error limits prescribed by CBIP.

The accuracy of the meter should not be affected with the application of abnormal voltage/frequency generating device such as spark discharge of approximately 35 kV. The meter shall be tested by feeding the output of this device to meter in any of the following manner for 10 minutes:

i) On any of the phases or neutral terminals.
ii) On any connecting wires of the meter.
iii) Voltage discharge with 0-10 mm spark gap
iv) At any place in load circuit

The accuracy of meter shall be checked before and after the application of above device(s) with site conditions. Also, meter shall be tested for Immunity to Conducted Disturbances in accordance to IEC 62052-11 and any other tests as per relevant standards can be carried out.

The bidder should furnish the details as to how their meter is able to detect/protect the above tampers and fraud with sketches and phasor diagrams wherever necessary. If bidder has any better proposal for tamper logic, the same may be submitted along with the offer for purchaser's consideration. Additional features, If any, in their meter may also be clearly indicated.

8. a) The meter shall record active energy in forward direction even if one or more CT's are reversed.
The current vector direction shall always be considered as positive (import) for the computation of 3 Phase active energy which shall be added in the main active energy (import) register.

b) The meter shall record apparent energy in forward direction even if one or more CT's are reversed. KVAh computation shall be based on reactive lag energy only. However provision shall bc made to compute KVAH on lag and lead energies if required in future.

c) The maximum demand shall be computed from the main active energy registers. However there should be provision to select apparent energy as demand whenever required.

9. The meter cover should be ultrasonically welded with meter base. The cover shall not just be held with base on two points of sealing. It should be supported all along the boundary of base and cover of the meter as well, so that even before ultrasonic welding, the cover should

be fit perfectly with the base. The ultrasonic welding of meter case shall be such that if in case of any attempt to open the meter cover from base, there should be a clearly visible evidence of opening / tampering of meter case, **meter shall display "Meter cover open" permanently.**

20. Deleted

21. Deleted

22. PERFORMANCE UNDER IN FLUENCE QUANTITIES:

The meters performance under influence quantities shall be governed by IS 14697-1999 (reaffirmed 2004). The accuracy of meter shall not exceed the permissible limits of accuracy as per standard IS: 14697 (latest version).

23. QUANTITIES TO BE MEASURED & DISPLAYED

The meter shall be capable of measuring and displaying the following electrical quantities within specified accuracy limits for polyphase balanced or unbalanced loads:

a) Instantaneous Parameters such as phase and line voltages, currents, power factors, overall kVA kW kVAr, power factor, frequency etc as per details given in the table below and enclosed annexure.

b) Block Load Profile Parameters such as kVAh/kWh/kvArh (lag/lead)/Maximum Demand (MD) in kW/kVA/power factor/phase and line voltages/currents etc (minimum 5 parameters) as per details given in the table below and enclosed annexure.

In addition to above the meter shall also record the Name plate details, programmable parameters (readable as profile), occurrence and restoration of tamper events along with the parameters (Table A5.1, A5.2 and A6.1 to A6.8 respectively of enclosed guideline document)

Detail of category wise paramcters requirement suitable for specific location such as feeder/DT metering, interface points/boundary points is given in following tables of guidelines document enclosed as annexure:

Category	Parameter group	Annexure Table:No.
Substation Feeder/ Distribution Transformer meter	Instantaneous parameters	All
	Block Load Profile parameters	A2.2
Boundary/Ring fencing/Interface Meters	Instantaneous parameters	A3.1
	Block Load Profile parameters	A3.2
	Daily Load Profile parameters	P3.3
HT Consumer Meters	Instantaneous parameters	A4.1
	Block Load Profile parameters *	A4.2
	Billing Profile parameters	A4.3
Substation Feeder!	Name Plate details	A5.1

Distribution Transformer/Boundary/Ring fencing/Interface/HT Consumer Meters	
Programmable Parameters	A5.2
Event Conditions	A6.1 to A6.7
Logging parameters for each of the event condition — shall be selected	Capture parameters for event Afr8.. as applicable (Event Log Profile)

24. METER SERIAL NUMBER :

In addition to providing serial number of the meter on the display plate, the meter serial number shall also be programmed into meter memory for identification through CMRI/meter reading print out.

25. DISPLAY SEQUENCE :

The meter shall display the required parameters in two different modes as follows:-

A) Auto Display Mode:

The following parameters hereinafter referred to as "Billing Parameters" (B.P) shall be displayed in an auto-cyclic mode, in the following sequence with a persistence time of 9-10 seconds.

1	LCD Check
2	Meter Serial Number
3	Date & Time
4	Running MD in kW with date
5	Running PF
6	Billing MD since last reset with date and time
7	Billing PF since last reset with date and time
8	First Previous Month Cum kWh (b1)
9	Second Previous Month Cum kWh (b2)
10	First Previous Month MD in kW with date& Time (b1)
11	Billing KVAh
12	Billing Avg Power factor
13	Cumulative kWh
14	Cumulative Lag kVArh

15	Cumulative Lead kVArh
16	Cumulative kVAh
17	Phase sequence & Phase Association
18	Phase wise Currents
19	Phase wise Voltages
20	Phase wise Instantaneous pf
21	Instantaneous total pf
22	Frequency
23	Instantaneous Apparent Power
24	Instantaneous Active Power
25	Instantaneous Reactive Power
26	Total Power Failure Hours
27	Power Failure Count
28	Total Tamper Count
29	Anamoly
30	Reset Count

B) Push Button Mode:

The following parameters, in the sequence given below, shall be displaycd on pressing the push button(s) ,two buttons for up and down navigation of parameters to be provided:

	Push Mode
1	LCD Check
2	Meter Serial Number
3	Date & Time
4	First Previous Month Cum kWh (b1)
5	Second Previous Month Cum kWh (b2)
6	First Previous Month MD in kW with date& Time (b1)
7	Billing KVAh
8	Billing Avg Power factor
9	Cumulative kWh
10	Cumulative Lag kVArh
11	Cumulative Lead kVArh

12	Cumulative kVAh
13	Phase sequence & Phase Association
14	Phase wise Currents
15	Phase wise Voltages
16	Phase wise Instantaneous pf
17	Instantaneous total pf
18	Frequency
19	Instantaneous Apparent Power
20	Instantaneous Active Power
21	Instantaneous Reactive Power
22	Running MD in kW with date
23	Running PF
24	Total Power Failure Hours
25	Power Failure Count
26	Total Tamper Count
27	Anamoly
28	Reset Count
29	Phase wise Voltage Failure Count
30	Current Open Status Count
31	Voltage Unbalance Count
32	Current Unbalance Count
33	Current Bypass Count
34	Current Reversal Count
35	Over Voltage Count
36	Over Current Count
37	Neutral Disturbance Count
38	Magnetic Tamper Count
39	Cover Open Status
40	Date & Time of Cover Open
41	RTC status
42	Battery status
43	First Previous Month billing Energy in kWh

44	Second Previous Month billing Energy in kWh
45	Third Previous Month billing Energy in kWh
46	Fourth Previous Month billing Energy in kWh
47	Fifth Previous Month billing Energy in kWh
48	Sixth Previous Month billing Energy in kWh
49	First Previous Month billing MD in kw
50	Second Previous Month billing MD in kW
51	Third Previous Month billing MD in kW
52	Fourth Previous Month billing MD in kW
53	Fifth Previous Month billing MD in kW
54	Sixth Previous Month billing MD in kW
55	First Previous Month billing pf
56	Second Previous Month billing pf
57	Third Previous Month billing pf
58	Fourth Previous Month billing pf
59	Fifth Previous Month billing pf
60	Sixth Previous Month billing pf
61	**Zone wise billing C kWh and MD in kw of previous month (b1)**
62	**Zone wise Cumulative kWh and MD in kw**
HR Mode: (2+6)	
1	**Cumulative kWh, kVArh lag & lead, kVAh**

The following parameters shall be displayed on demand.

(i) High-resolution display of cumulative KWh, KVAh & RKVAh shall be of minimum eight digits, with two digits for integers and six digits for decimals.

(ii) Demand with elapsed time.

(iii) Cumulative period of failure of potential in each phase shall be displayed in months / days / hours / minutes from the date of Installation.

(iv) Cumulative period of failure of current in each phase shall be displayed in months / days / hours / minutes from the date of Installation.

(v) Cumulative period of failure of power shall be displayed in months / days / hours / minutes from the date of Installation.

(vi)Tamper Count (First in, First out basis)

Note: Failure of potential, failure of current and failure of power shall be displayed in days, hours and minutes from the date of installations. 12 months/of billing parameters should be provided in demand mode.

CT Operated push button display:

					TOD for six month		
Months	MD	Energy				MD	Energy-1
Aug. (Current month)	MD	kWh	kvah	PF		MD0	C0
July	MD1	kWh1			1	MD1	C1
June	MD2	kWh2				MD2	C2
May	MD3	kWh3				MD0	C0
April	MD4	kWh4			2	MD1	C1
March	MD5	kWh5				MD2	C2
February	MD6	kWh6				MD0	C0
					3	MD1	C1
						MD2	C2
						MD0	C0
					4	MD1	C1
						MD2	C2
						MD0	C0
					5	MD1	C1
						MD2	C2
						MD0	C0
					6	MD1	C1
						MD2	C2
					. . . . .		
					12		

C. Battery mode parameters : The meter shall have industrial grade rechargeable long life battery with sufficient capacity to enable the meter reader to take meter reading even under power off conditions. The same push button shall be used for displaying the readings included in auto scroll mode only during power outages.

26. OUT PUT DEVICE :

The meter shall have a test output accessible from the front and be capable of being monitored with suitable testing equipment. The operation indicator, if fitted, must be visible from the front. Test output device shall be provided in the form of LED/LCD(s) for active and reactive energies. **Resolution of the test output device shall be sufficient to enable the starting current test in less than 10 minutes.**

The LCD shall be of STN (Super Twisted Nematic)/HTN (High Twisted Nematic) type, construction suitable for temperature withstand of 80°C (storage) and 65° C (operation). The LCD Display should have a wide viewing angle of 45° to 60° cone, up to one meter distance.

27. Real Time Internal Clock (RTC)

RTC shall be pre-programmed for 30 Years Day/date without any necessity for correction. The maximum drift shall not exceed +/- 300 Seconds per year.
The clock day/date setting and synchronization shall only be possible through password/Key code command from one of the following:
a) Hand Held Unit (HHU) or Meter testing work bench and this shall need password enabling for meter;
b) From remote server through suitable communication network or Sub-station data logger 'PC'.

28. DEMAND INTEGRATION PERIOD

The maximum demand integration period shall be set at 30 minute & provision shall be made to program the period to 15 minute.

29. MD RESET

It should be possible to reset MD by the following options:

a) Local push button
b) Auto reset at 24:00 hrs at the end of each billing cycle.
c) The meter shall be capable of resetting MD even when there is no power supply during whole month.

30. COMMUNICATION CAPABILITY

The meter shall be provided with two ports for communication of the measured/collected data as per guideline document enclosed in the annexure, i e a hardware port compatible with RS 232 port shall be of RJ 11 type connectivity to enable RAMR specifications which shall be used for remote access through suitable Modem (GPRS/GSM/EDGE/CDMA/PSTN/LPR) and an Optical port complying with hardware specifications detailed in IEC-62056-21. This shall be used for local data downloading through a DLMS compliant HHU.
The RS 485 port shall be used at Substations suitable for multi-drop connections of the meter for exporting data to sub-station data logger/DCU/Computer and the remote end server. The RS 232 port shall be used at boundary points meters, Distribution Transformer meters for consumer meters, capable to transfer and export data to the remote end server through, suitable communication mediums

(GPRS/GSM/EDGE/CDMA/ PSTN/LPR) Both ports shall support the default and minimum baud rate of 9600 bps.

31. MAXIMUM DEMAND (MD) REGISTRATION :

The meter shall continuously monitor and calculate the average demand in active energy during the integration period set and the maximum, out of these, shall be stored along with date and time when it occurred in the meter memory. The maximum registered value shall also be made available on meter-display.

The rising demand under the current integration period should be displayed along with the elapsed time.

The integration period shall be set as 30 minutes, on real- time basis. The meter shall have provision for maximum demand resetting through sealable push button and automatically at 24.00 hours of the last day of the calendar month irrespective of the meter is powered On or Off during the whole month. The meter shall display the maximum demand reset count. All MD reset shall be recorded as an event.

32. MAXIMUM DEMAND RESET :

Facility for auto reset of MD at predefined date & time shall be provided. The meter shall display the maximum demand reset count.

33. LOAD SURVEY CAPABILITY & BILLING POINT REQUIREMENTS :

a) The meter shall be capable for storing ½ hour data for the following parameters for the last 45 days and necessary facilities to transfer this data for easy communication to data collection device i.e., MRI / Hand Held Reader (H.H.R) or PC to get the details in both numerical and graphic forms. The supply of required software for this purpose is included in the scope of supply. The software shall be compatible for use with IBM compatible PC and also with both serial port and USB port The meters have the RRAMR interface facilities.

Parameters required for load survey:

- **KWH**
- **KVAh**
- **KVArh lag**
- **KVArh lead**
- **Voltage (avg. of 30 – min period) phase wise**
- **Current (avg of 30 – min period) phase wise.**

The predefined date and time for registering the billing parameters of active, apparent, power factor and apparent Maximum Demand readings shall be 00.00 hours of the first day of each calendar (billing) month. All billing paramcters shall be transferred to billing registers and shall be displayed on auto cyclic display mode referred to as "BILLING PARAMETERS". Additionally manual resetting shall be provided using a push button.

The following additional parameters should be made available at the Base Computer Software (BCS) end:

a) MD reset count.
b) Billing Parameters for last 6 Histories.

34. TIME-OF-DAY (TOD) TARIFF/DEMAND :

Minimum of Eight TOD shall be provided and each TOD shall have display of import of KVAh, KWh, MD in KW, KVA, Avg, P.F. and facility to down load through MRI to PC and print out.

Following zones are to be pre-programmed in thc meter. Necessary software shall be provided in MRI for changing these zones if required in future

The present time zones are as follows.
TZ1 - 06:00 Hrs to 10:00 IIrs
TZ2 - 10:00 Hrs to 18:00 Hrs
TZ3-18:00 Hrs to 22:00 Hrs
TZ4 - 22:00 Hrs to 06:00 Hrs

Suitablc software for invoking display parameters pertaining to these TOD's in auto scrolling mode & change in TOD zones.

35. SELF DIAGNOSTIC FEATURE :

Thc meter shall have indications for unsatisfactory / nonfunctioning / malfunctioning of the following:

(a) Time and date on meter display.
(b) All display segments on meter display
(c) Non Volatile Memory Status on display and downloaded data.

36. Tamper Events Detection:

The meter shall work satisfactorily under presence of various influence conditions like external magnetic field, electromagnetic field Radio Frequency Interference, Harmonic distortion, Voltage/frequency Fluctuations & Electro Magnetic High Frequency fields etc,

The meter shall be immune to abnormal voltage/frequency Generating devices & shall record the occurrence & restoration of such tamper events along with parameters such as current, voltage, KWh, PF event code, date & time & etc.

Tamper detail shall be stored in internal memory for retrieval by authorized personnel through either of the following:

1. HHU
2. Remote access through suitable communication network.

The meter should have features to detect the occurrence and restoration of, at least, the following common ways of abnormalities:

- **Potential failure:** The meter shall be capable of detecting and recording occurrences and restoration of potential failure (one phase/two phases) which can happen due to intentional / accidental disconnection of potential leads. The meter should also record event as a potential failure, when one phase line fuse failure from the main side.

- **Current Polarity Reversal:** The meter shall be capable of detecting and recording occurrences and restoration of current polarity reversal of one or more phases which can be happen due to wrong connection of current leads.

- **Current Circuit Open:** The meter shall be capable of detecting and recording occurrences and restoration of opening of any one or two phases of current circuit which can happen due to intentional / accidental disconnection of current circuits. No load condition should record in meter memory as a Current circuit open event.

- **Current Unbalance:** The meter shall be capable of detecting and recording occurrences and restoration of current unbalance as an event.

- **Voltage Unbalance:** The meter shall be capable of detecting and recording occurrences and restoration of voltage unbalance as an event. The above information should be possible to download from the meter through hand held unit and available at BCS end.

- **Power on/off**: The meter shall be capable to record power on /off events in the meter memory. All potential failure should record as power off event.

- Minimum three hundred (300) events (including occurrence & restoration) of all types of abnormality event with date and time shall be available in the meter memory on first-in, first-out basis. It shall be possible to retrieve the event data along-with all related snap- shots' data through the meter's optical port and through radio with the help of a hand held unit (HHU) and download the same to the BCS where it shall be available for viewing.

  The meter shall be capable of storing any continuous failure/tamper until it is set right.
  Tamper and fraud protection clause shall be included as per IS 15959 and 0.2s class meter specification

37. Event Detection Logic :

Properly designed meter tamper logic should be provided. The tamper logic should be capable of discriminating the system abnormalities from source side and load side.

There shall be compartments for logging of different types of tampers.

The logging of various tampers in each compartment should be explained by bidder.

Once one or more compartments have become full, the last tamper event pertaining to the same compartment will be entered and the earliest (first one) tamper event should disappear. Thus, in this manner each succeeding tamper event will replace the earliest recorded event, compartment wise. Events of one compartment/category should overwrite the events of their own compartment/category only.

Tamper count should increase as per occurrence (not restoration) of tamper events. The total number of tamper counts should also be provided on the meter-display as well as at the BCS end.

38. EVENT PERSISTENCE TIME:

The persistence time for logging/ registration of an occurrence & restoration of the tamper should be explained by the supplier.

39. ACCURACY REQUIREMENT :

The accuracy of parameters measured by meters shall be tested in accordance with the relevant standards described in clause 2.0 of this specification.

40. ELECTRICAL REQUIREMENT :

The electrical requirement of meters shall be as specified in the relevant standards described in clause 2.0 of this specification.

41. ELECTROMAGNETIC COMPATIBILITY AND INTERFERENCE REQUIREMENT:

The meter shall meet EMI/EMC requirements as specified in the relevant standards described in clause 2.0 of this specification.

42. MECHANICAL REQUIREMENT :

The meter shall meet the mechanical requirements as specified in the relevant standards described in clause 2.0 of this specification.

43. CLIMATIC INFLUENCE REQUIREMENT:

The meter shall meet Dry Heat/Cold/Damp heat cyclic test requirements as per the relevant standards described in clause 2.0 of this specification.

44. RANDOM SAMPLE TESTING AFTER RECEIPT OF METERS (Type tests).

After start of supplies and within the contract period the owner at any time will select sample meters out of the supplied meters of successful Bidders for testing at CPRI for conducting type tests and other tests as per relevant IS as mentioned in this specification at the cost of utility. The Bidder's representative can also be present at the time of selection. If the meters fail in the tests, action will be initiated as per terms and conditions of bid documents.

45. SAMPLES FOR TESTING (Conducted for evaluation of bid)

a) Two nos. of sample meters conforming to this specification duly sealed along with the routine test certificates shall be furnished with the bid.

Note:- The main cover of one of the sample meters to be submitted along with the bid should be ultrasonically welded. The main cover of the other sample meter need not be ultrasonically welded, as at the time of sample testing, it shall be opened to ascertain conformity of meter's internal parts as per specification.

46. QUALITY ASSURANCE PLAN

(A) The design life of the meter shall be minimum 10 years and to prove the design life, the firm shall have at least the following quality Assurance Plan:

i. The factory shall be completely dust proof.
ii. The testing rooms shall be temperature and humidity controlled as per relevant standards.
iii. The testing and calibrating equipments should be automatic and all test equipment shall have their valid calibration certificates.
iv. Power supplies used in testing equipment shall be distortion free with sinusoidal wave - forms and maintaining constant voltage current and frequency as per the relevant standards.
v. During the manufacturing of the meters the following checks shall be carried out.

a) Meter frame dimensions tolerance shall be minimum.
b) The assembly of parts shall be done with the help of jigs and fixtures so that human errors are eliminated.
c) The meters shall be batch tested on automatic, computerized test bench and the results shall be printed directly without any human errors.

(B) The bidder shall invariably furnish the following information along with his bid, failing which his bid shall be liable for rejection. The information shall be separately given for individual type of material offered.

i. Statement giving list of important raw materials, names of sub suppliers

for the raw materials, list of standards according to which the raw materials are tested! List of tests normally carried out on raw material in presence of bidder's representative and copies of test certificates.

ii. Information and copies of test certificates as in (i) above in respect of bought out accessorics.

iii. List of manufacturing facilities available.

iv. Level of automation achieved and list of areas where manual processing exists.

v. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.

vi. List of testing equipment available with the bidder for final testing of equipment specified and test-plant limitations, if any, vis-a -vis the type, special acceptance and routine tests specified in the relevant standards and this specification. These limitations shall be very clearly brought out in schedule of deviations provided with the tender.

47. GUARANTEED TECHNICAL PARTICULARS

The bidder shall furnish all the necessary information as desired in the schedule of Guaranteed Technical Particulars and data, appended. If the bidder desires to furnish any other information (s) in addition to the details as asked for, the same may be furnished against the last item of this schedule.

48. PACKING AND FORWARDING

The meters shall be packed in cartons /crates suitable for vertical/horizontal transport as the case may be, and suitable to withstand handling during transport and outdoor storage during transit. The supplier shall be responsible for any damage to the equipment during transit, due to improper and inadequate packing. The easily damageable material shall be carefully packed and marked with the appropriate caution symbol. Proper arrangement for lifting, such as lifting hooks or handles etc., shall be provided. Any material found short or broken inside the packing cases shall be supplied immediately by supplier without any extra cost.

The packing shall be done as per the manufacturer's standard practice. However, packing should be safe and water-proof and manufacturer should ensure the packing is such that, the material should not get damaged during transit by Rail/Road.

49. MAINTENANCE & GUARANTEE:

The Guarantee period of the offered meter shall be 66 months from the date of supply or 60 months from the date of installation whichever is earlier. The bidder shall replace the defective meters within a period of 14 days from the date of intimation from the concerned Consumer or from the BESCOM authorities. The guarantee for the replaced meters shall start from the date of such replacement which shall be marked on name plate. In case defective meters are not replaced in stipulated period the penalty as per clause of delay in delivery shall be applicable.

50. TESTS:

The test reports/certificate/records for all type tests specified having been successfully performed on the type of the meter offered shall be submitted with the tender. The bidder shall clearly bring out the deviations from this specification clause by clause whether on account of tests or manufacturing process or features incorporated in the meter. The tender lacking with above information and withou supporting test reports for meter meeting the requirement of tests laid in this specification are likely to be rejected.

51. Real power should be sum of fundamental and harmonics.

52. Display resolution

Voltage – 0.01V
Current – 0.01A
Power factor -0.001
Active energy – 0.01 Kwh
Reactive energy – 0.01KVArh
Apparent energy – 0.01Kvah
Demand -0.0001KVA

53. Type of display - The meter should have bright LCD electronic display with back lit with minimum description of parameters (eg., words like kWh, kVArh, (lag/ lead), kW, kVA pf, billing parameters like b01, b02....., TOD zone parameter t01, t02....).